Davis, Gregory

From: Jay Vance [jvance@redleafinc.com]
Sent: Friday, July 12, 2013 11:10 AM
To: Davis, Gregory
Subject: USE THIS ONE -- Red Leaf Resources' EcoShale technology

Greg,
My apologies for sending this second msg.
Could you use the version below instead and discard the previous write up.
This has updated information.
Let me know if you'd like additional information.
Thanks,

Jay K. Vance, P.E.
Manager, Environmental & Permitting

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Facility Legal Location
Portions of Sections 19, 20, 29 and 30, Township 13 South, Range 23 East; portions of Sections 25 and 36 of Township 13 South, Range 22 East. All sections are located in Uintah County, Utah. The Universal Transverse Mercator Geographic Coordinate System (UTM) coordinates for the facility are: Zone 12 Northing 4390671.43, Easting 638650.23. Latitude and longitude: 39o 39' 23" north latitude, 109o 23' 04" west longitude.

Red Leaf Resources, Inc. (RLR), a privately held corporation, has developed the EcoShale(tm) In-Capsule Technology to extract petroleum from oil shale. RLR is proving the new technology at a location in eastern Utah. The EcoShale(tm) In-Capsule Technology uses heat to extract kerogen from oil shale as gases and liquids.

This operation, Southwest #1 Project, is located approximately 55 miles south of Vernal, in Uintah County, Utah.

Following oil extraction, the shale will remain encapsulated in place for final disposition, with no identified potential impact to surface or ground water resources.

Since October 2008 when RLR initiated construction of a test facility, RLR has been in continuous operation with activities including site construction, testing and scale-up of the EcoShale(tm) In-Capsule Technology test unit, operations and maintenance. The operation consists of simultaneously mining the oil shale and creating the heating capsules for extracting oil.

The facility is currently operating under the authority of a Small Mine Operation (SMO) Permit issued by the Utah Division of Oil Gas and Mining (UDOGM). RLR intends to expand activities at Southwest #1 small mine site by converting to a Large Mining Operation (LMO). Mining will initiate in SE1/4 of Section 30, T13S, R23E with its first capsule. Upon successful completion of the first capsule and a corporate decision to proceed, construction of subsequent capsules may progress east to west and south to north.

The new facility will be an oil shale production operation to extract petroleum compounds contained in kerogen from mined oil shale ore. It includes equipment maintenance, laboratory support facilities, and ancillary facilities, as necessary.

The Standard Industrial Classification (SIC) and North American Industry Classification System (NAICS) codes that describe the proposed facility are 1311 (SIC) and 211111 (NAICS) for petroleum extraction, production, and oil shale mining and beneficiating.

The development of the full-scale mining and oil-production operation will begin with a single capsule, which is termed the early production system or EPS capsule. It will be approximately 75 percent of the size of the full commercial scale capsules and unlike them, will not be constructed sequentially with other capsules.

The EcoShale(tm) In-Capsule Technology uses heat to extract petroleum compounds contained in kerogen from oil shale deposits to produce crude oil. The operation is designed to maximize resource recovery and accommodate construction of "capsules" designed for low temperature heating of the shale to extract the hydrocarbons as gases and liquids. The operation consists of the simultaneous mining of the oil shale and the construction of the heating capsules. All materials mined are utilized completely and play a role in the RLR technology for capsule construction, hydrocarbon extraction and reclamation. The general mining sequence will consist of the following unit operations:

* Land clearing (where required)
* Soil removal and stockpiling

* Pre-stripping of unconsolidated overburden (when required)
* Drilling, blasting overburden
* Overburden removal
* Overburden loading, hauling, and screening
* Drilling, blasting of ore and interburden
* Ore and interburden loading, hauling, and screening
* Selective use of screened materials in construction of capsules
* Heating and kerogen recovery
* Final grading
* Soil placement and revegetation

The mine plan includes clearing and grubbing operations, installation of stormwater control, salvaging of soil, followed by mining of the overburden, interburden, and oil shale. Topsoil is salvaged and carefully stockpiled to be used during the reclamation phase.

Once enough overburden is removed from the pit area to create a capsule, an impermeable liner of bentonite-amended shale (BAS) is placed on the bottom of the capsule to prevent impacts to groundwater and the surrounding ecosystem. Manufacture of the capsule-sealing BAS involves using a special size fraction of materials mixed with bentonite and appropriate quantities of water in a pug mill (or similar equipment) to produce a bentonite sealing material for placement in the capsules. The BAS will be mixed, placed at optimal moisture content and compacted as necessary. Alternative methods for BAS placement may be used. The saturated hydraulic conductivity of the BAS layer will be 1×10^{-7} cm/sec or less. A three-foot layer of BAS will surround each capsule, top, bottom, sides, and ends.

Inside the BAS layer is a rind of earthen material which serves as insulation inside the BAS barrier to conserve heat and protect the BAS from thermal breakdown. A steel liquids-collection pan will be installed within the insulating layer at the bottom of each capsule to direct the liberated petroleum liquids to a collection system and to prevent loss of oil to the underlying liner or the environment. The pan is sloped to direct liquids to a collection trough, which in turn direct liquids to sumps over grated vertical delivery pipes at an engineered bulkhead system.

Above the bottom insulation layer, approximately 100 feet of ore will be placed within the cell in lifts at the same time the side walls, end walls and insulation layers are built. The mined material is placed in layers with corrugated steel heating pipes throughout the capsule. The ore and heating pipes will be incrementally stacked on top of one another in the capsules. Initially, each capsule would be heated to approximately the boiling point of water and held at that temperature until steam production diminishes. This step is completed prior to increasing the heat to pyrolysis temperatures. The heating pipes heat the ore to a maximum temperature of approximately 725 ^{o}F and, through pyrolysis, liberate liquid and gaseous components of kerogen. Separate

collection channels and pipes conduct the liquids and gases to the north end of the capsule.
The capsules are designed with a pitched cover surface that will distribute stress across the upper BAS layer and accommodate settling at the edge to protect the constructed BAS wall which, with the covering BAS, seals the capsule.

The EPS capsule will be a stand-alone capsule approximately three-fourths the size of a full scale commercial capsule. It will be constructed in the southeast portion of Section 30, T13S, R23E. Its location relative to the commercial scale capsules flights is discussed in Section 10.2. The capsule will have BAS floor dimensions of approximately 385 feet wide by 695 feet long by 100 feet high at the capsule edge (and approximately 161 feet high at the top of each capsule crown). The capsule walls will be buttressed on all four sides by engineered fill.

Key components of the EPS capsule are designed to standards believed necessary to confirm proofs of concept for the key design components. These standards are intended to enable observation, measurement, and assessment of the key design concepts and components during the EPS. What is learned during EPS will be applied to the final design of the commercial scale capsules. The key concepts and components include the bedding materials for piping, pipe sizing and spacing, insulation effectiveness, design effects on fluid and gas recovery, bulkhead design, including BAS penetrations for heating and product recovery piping, heat delivery and product recovery manifold effectiveness, BAS thickness, construction procedures, capsule dimensions, and capsule containment effectiveness, especially roof performance during capsule settling. Changes to these capsule and system features may be made prior to EPS construction as more information becomes available; however, any such changes to these features will ensure that the functionality of each design and system component is maintained.

From: Jay Vance
Sent: Friday, July 12, 2013 10:39 AM
To: 'davis.gregory@epa.gov'
Subject: Red Leaf Resources' EcoShale technology

Greg,
Per your request, below is a write up on Red Leaf Resources' EcoShale technology.
The EPS capsule is the one we're working on and talking about.
Let me know if you'd like additional information.
Jay Vance

Jay K. Vance, P.E.
Manager, Environmental & Permitting

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